CLAIMS

1. (currently amended) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) two or more channel estimators, at least one channel estimator for each different data level for the received signal, each channel estimator being configured to model the transmission channel to generate an estimated signal corresponding to one of the data levels; and

(b) a comparator configured to (1) receive the received signal and the estimated signal from each channel estimator and (2) select an output data level for the received signal, wherein:

each channel estimator implements a 2nd order or higher model of the transmission channel; and

the model is an adaptive model of the transmission channel that is dynamically controlled based on an error signal generated by the comparator.

2-3. (canceled)

4. (currently amended) The receiver of claim [[2]] 1, wherein each channel estimator comprises a processing path for each order term in the model of the transmission channel.

5. (original) The receiver of claim 4, wherein at least one of the processing paths in each channel estimator comprises a multiplication node having an adaptive coefficient that is dynamically controlled based on an error signal generated by the comparator.

6. (original) The receiver of claim 5, wherein a processing path in each channel estimator corresponding to a 1st order term of the model with a coefficient having a value of 1, wherein the 1st order term processing path is implemented without a multiplication node.

7. (previously presented) The receiver of claim 1, further comprising one or more adaptive equalizers, each adaptive equalizer configured to receive an ideal data level signal corresponding to one of the data levels and to generate an input signal for one or more of the channel estimators.

8. (original) The receiver of claim 7, wherein at least one adaptive equalizer is shared by two or more of the channel estimators.

9. (original) The receiver of claim 8, wherein all of the channel estimators share a single adaptive equalizer.

10. (original) The receiver of claim 7, wherein each adaptive equalizer is further configured to receive one or more future data levels and the receiver comprises a channel estimator for each different combination of current and future data levels.

11. (previously presented) The receiver of claim 7, wherein tap data for each adaptive equalizer corresponds to sliced symbols corresponding to two or more of the data levels.

12. (original) The receiver of claim 1, wherein the comparator comprises:

(a) a subtraction node for each channel estimator configured to generate a difference signal between the received signal and the corresponding estimated signal; and

(b) a compare-and-select module configured to receive the difference signals from the subtraction nodes and to select the output data level for the received signal based on a difference signal having a smallest absolute value.

13. (original) The receiver of claim 1, wherein:

the transmission channel is an optical transmission channel; and

the two or more channel estimators and the comparator are implemented in a single integrated circuit as analog circuitry.

14. (currently amended) A method for processing a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the method comprising the steps of:

(a) generating at least one estimated signal for each data level based on a model of the transmission channel; and

(b) processing the received signal and the estimated signal for each data level to select an output data level for the received signal, wherein:

step (a) comprises the step of implementing a 2nd order or higher model of the transmission channel; and

the model is an adaptive model of the transmission channel that is dynamically controlled based on an error signal generated during step (b).

15-16. (canceled)

17. (original) The method of claim 14, further comprising the steps of:

(c) generating a difference signal between the received signal and the corresponding estimated signal; and

(d) selecting the output data level for the received signal based on a difference signal having a smallest absolute value.

18. (currently amended) The receiver of claim [[2]] 1, wherein the model of the transmission channel includes at least one of a 0th order term and a 1st order term.

19. (previously presented) The receiver of claim 18, wherein each channel estimator comprises a processing path for each order term in the model of the transmission channel.

20. (previously presented) The receiver of claim 7, wherein each channel estimator receives a different input signal from the one or more adaptive equalizers.

21. (previously presented) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) an adaptive equalizer, a corresponding channel estimator, and a corresponding subtraction node for each data level; and

(b) a compare-and-select module, wherein:

each adaptive equalizer is configured to receive an ideal data level signal for the corresponding data level and to generate an input signal for the corresponding channel estimator;

each channel estimator is configured to model the transmission channel to generate an estimated signal corresponding to said each data level, each channel estimator implementing a 2nd order or higher model of the transmission channel, wherein:

the model has at least a 0th order term, a 1st order term, and a 2nd order term; and

said each channel estimator comprises a processing path for each order term in the model;

each subtraction node is configured to generate a difference signal between the received signal and the corresponding estimated signal; and

the compare-and-select module configured to receive the difference signals from the subtraction nodes and to select the output data level for the received signal based on a difference signal having a smallest absolute value.

22. (previously presented) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) an adaptive equalizer;

(b) a set of ideal-data-level circuitry, a corresponding channel estimator, and a corresponding subtraction node for each data level; and

(c) a compare-and-select module, wherein:

the adaptive equalizer is configured to generate a single adapted equalizer signal for each set of ideal-data-level circuitry;

each set of ideal-data-level circuitry is configured to receive an ideal signal data level for the corresponding data level and to generate an input signal for the corresponding channel estimator;

each channel estimator is configured to model the transmission channel to generate an estimated signal corresponding to said each data level, each channel estimator implementing a 2^{nd} order or higher model of the transmission channel, wherein:

the model has at least a 0^{th} order term, a 1^{st} order term, and a 2^{nd} order term; and

said each channel estimator comprises a processing path for each order term in the model;

each subtraction node is configured to generate a difference signal between the received signal and the corresponding estimated signal; and

the compare-and-select module configured to receive the difference signals from the subtraction nodes and to select the output data level for the received signal based on a difference signal having a smallest absolute value.

23. (new) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) two or more channel estimators, at least one channel estimator for each different data level for the received signal, each channel estimator being configured to model the transmission channel to generate an estimated signal corresponding to one of the data levels; and

(b) a comparator configured to (1) receive the received signal and the estimated signal from each channel estimator and (2) select an output data level for the received signal, wherein:

each channel estimator implements a 2^{nd} order or higher model of the transmission channel;

each channel estimator comprises a processing path for each order term in the model of the transmission channel; and

at least one of the processing paths in each channel estimator comprises a multiplication node having an adaptive coefficient that is dynamically controlled based on an error signal generated by the comparator.

24. (new) The receiver of claim 23, wherein a processing path in each channel estimator corresponding to a 1^{st} order term of the model with a coefficient having a value of 1, wherein the 1^{st} order term processing path is implemented without a multiplication node.

25. (new) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) two or more channel estimators, at least one channel estimator for each different data level for the received signal, each channel estimator being configured to model the transmission channel to generate an estimated signal corresponding to one of the data levels;

(b) a comparator configured to (1) receive the received signal and the estimated signal from each channel estimator and (2) select an output data level for the received signal; and

(c) one or more adaptive equalizers, each adaptive equalizer configured to receive an ideal data level signal corresponding to one of the data levels and to generate an input signal for one or more of the channel estimators.

26. (new) The receiver of claim 25, wherein at least one adaptive equalizer is shared by two or more of the channel estimators.

27. (new) The receiver of claim 26, wherein all of the channel estimators share a single adaptive equalizer.

28. (new) The receiver of claim 25, wherein each adaptive equalizer is further configured to receive one or more future data levels and the receiver comprises a channel estimator for each different combination of current and future data levels.

29. (new) The receiver of claim 25, wherein tap data for each adaptive equalizer corresponds to sliced symbols corresponding to two or more of the data levels.

30. (new) The receiver of claim 25, wherein each channel estimator receives a different input signal from the one or more adaptive equalizers.

31. (new) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) two or more channel estimators, at least one channel estimator for each different data level for the received signal, each channel estimator being configured to model the transmission channel to generate an estimated signal corresponding to one of the data levels; and

(b) a comparator configured to (1) receive the received signal and the estimated signal from each channel estimator and (2) select an output data level for the received signal, wherein the comparator comprises:

(i) a subtraction node for each channel estimator configured to generate a difference signal between the received signal and the corresponding estimated signal; and

(ii) a compare-and-select module configured to receive the difference signals from the subtraction nodes and to select the output data level for the received signal based on a difference signal having a smallest absolute value.

32. (new) A receiver for a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the receiver comprising:

(a) two or more channel estimators, at least one channel estimator for each different data level for the received signal, each channel estimator being configured to model the transmission channel to generate an estimated signal corresponding to one of the data levels; and

(b) a comparator configured to (1) receive the received signal and the estimated signal from each channel estimator and (2) select an output data level for the received signal, wherein:

each channel estimator implements a 2^{nd} order or higher model of the transmission channel; and

the model of the transmission channel includes at least one of a 0^{th} order term and a 1^{st} order term.

33. (new) The receiver of claim 32, wherein each channel estimator comprises a processing path for each order term in the model of the transmission channel.

34. (new) A method for processing a received signal having two or more data levels, the received signal having been transmitted over a transmission channel, the method comprising the steps of:

(a) generating at least one estimated signal for each data level based on a model of the transmission channel;

(b) processing the received signal and the estimated signal for each data level to select an output data level for the received signal;

(c) generating a difference signal between the received signal and the corresponding estimated signal; and

(d) selecting the output data level for the received signal based on a difference signal having a smallest absolute value.

REMARKS/ARGUMENTS

Claims 1-22 were previously pending in the application. Claims 2-3 and 15-16 are canceled; claims 1, 4, 14, and 18 are amended; and new claims 23-34 are added herein. Assuming the entry of this amendment, claims 1, 4-14, and 17-34 are now pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

Prior Art Rejections

In paragraph 2, the Examiner rejected claims 1-2, 4, and 14-15 under 35 U.S.C. 102(e) as being anticipated by Barton. In paragraph 3, the Examiner rejected claim 13 under 35 U.S.C. 103(a) as being unpatentable over Barton in view of Gerlach. In paragraph 4, the Examiner allowed claims 21 and 22. In paragraph 5, the Examiner objected to claims 3, 5-12, and 16-20 as being dependent upon a rejected base claim, but indicated that those claims would be allowable if rewritten in independent form. For the following reasons, the Applicant submits that all of the now-pending claims are allowable over the cited references.

Claim 1 has been amended to include the features of original claims 2 and 3. As such, currently amended claim 1 is equivalent to original claim 3 rewritten in independent form. Since the Examiner stated that original claim 3 would be allowable if rewritten in independent form, the Applicant submits that currently amended claim 1 is allowable. Since claims 4-13 and 18-20 depend variously from claim 1, it is further submitted that those claims are also allowable.

Claim 14 has been amended to include the features of original claims 15 and 16. As such, currently amended claim 14 is equivalent to original claim 16 rewritten in independent form. Since the Examiner stated that original claim 16 would be allowable if rewritten in independent form, the Applicant submits that currently amended claim 14 is allowable. Since claim 17 depends from claim 14, it is further submitted that claim 14 is also allowable.

In view of the foregoing, the Applicant submits that the rejections of claims under 102(e) and 103(a) have been overcome.

New Claims

Support for new claims 23-34 is as follows:

New Claim	Support
23	Original claims 1, 2, 4, and 5
24	Original claim 6
25	Original claims 1 and 7
26	Original claim 8
27	Original claim 9
28	Original claim 10
29	Original claim 11
30	Original claim 20
31	Original claims 1 and 12
32	Original claims 1, 2, and 18
33	Original claim 19
34	Original claims 14 and 17

New claim 23 is equivalent to original claim 5 rewritten in independent form. Since the Examiner stated that original claim 5 would be allowable if rewritten in independent form, the Applicant submits that new claim 23 is allowable. Since claim 24 depends from claim 23, it is further submitted that claim 24 is allowable.

New claim 25 is equivalent to previously presented claim 7 rewritten in independent form. Since the Examiner stated that previously presented claim 7 would be allowable if rewritten in independent form, the Applicant submits that new claim 25 is allowable. Since claims 26-30 depend variously from claim 25, it is further submitted that those claims are also allowable.

New claim 31 is equivalent to original claim 12 rewritten in independent form. Since the Examiner stated that original claim 12 would be allowable if rewritten in independent form, the Applicant submits that new claim 31 is allowable.

New claim 32 is equivalent to previously presented claim 18 rewritten in independent form. Since the Examiner stated that previously presented claim 18 would be allowable if rewritten in independent form, the Applicant submits that new claim 32 is allowable. Since claim 33 depends variously from claim 32, it is further submitted that claim 33 is also allowable.

New claim 34 is equivalent to original claim 17 rewritten in independent form. Since the Examiner stated that original claim 17 would be allowable if rewritten in independent form, the Applicant submits that new claim 34 is allowable.

In view of the above amendments and remarks, the Applicant believes that the now-pending claims are in condition for allowance. Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,

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